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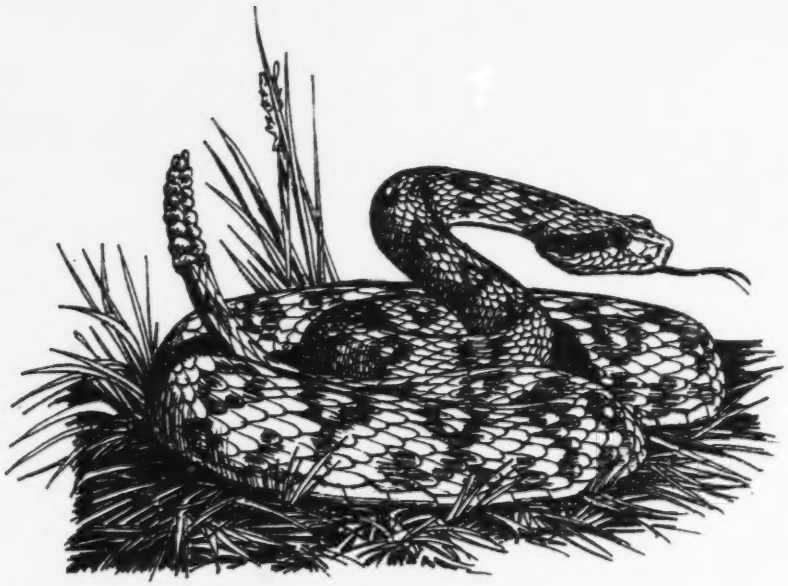
Lethbridge Prairie Rattlesnake Conservation Project: 2002/2003 Progress Report



Alberta Species at Risk Report No. 64

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

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Lethbridge Prairie Rattlesnake Conservation Project: 2002/2003 Progress Report

Reg Ernst

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February 2003

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SUSTAINABLE RESOURCE DEVELOPMENT

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EXECUTIVE SUMMARY

The coulees of southwest Lethbridge are home to a population of prairie rattlesnakes (*Crotalus viridis v.*), estimated at fewer than 50 adults. High rates of mortality from road kills and human persecution, as well as a rapid loss of habitat from subdivision and recreational development, make the future of Lethbridge rattlesnakes uncertain.

In May 2001, an artificial hibernaculum was constructed in secure parkland in Cottonwood Park. Problem and vulnerable rattlesnakes captured in urban areas were relocated and maintained there until their release during the spring of 2002. Passive integrated transponder (PIT) tags were implanted for long-term identification and monitoring, and transmitters were attached externally to the rattles of eight adult rattlesnakes prior to release. Subsequently, rattlesnake dispersal, movements, activities, and habitat use were monitored using radio telemetry. Technical and design problems with the radio transmitters prevented an accurate evaluation of the effectiveness of externally attached transmitters as a means of radio tracking prairie rattlesnakes.

Data collected was used to test the assumption that if rattlesnakes successfully over-winter at the artificial facilities and if habitat features are suitable, they will adopt Cottonwood Park as their home range and return to the artificial den to hibernate during the fall of 2002. Results indicated that 3 of the 9 rattlesnakes released from the Cottonwood Park hibernaculum during the spring of 2002 returned to the enclosure in the fall; however, no assumptions can be made from these results because the fate of the other 6 rattlesnakes is unknown.

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1.0 INTRODUCTION

Lethbridge is at the western edge of prairie rattlesnake range in Canada. The natural areas associated with the Oldman River of southwest Lethbridge are home to a small population of prairie rattlesnakes, estimated at fewer than 50 adults. Continued expansion of the Paradise Canyon and Riverstone subdivisions has resulted in a substantial loss of suitable rattlesnake habitat. In addition, increased mortality rates due to road kills in the Paradise Canyon and Popson Park areas, deliberate killing by humans, and the slow reproductive rates of prairie rattlesnakes make special efforts necessary to maintain a sustainable population of rattlesnakes in Lethbridge.

In 2001, the decision was made to focus recovery efforts on establishing a population of rattlesnakes in Cottonwood Park (see Appendix 2 for a detailed summary on conservation strategy rationale). The strategy to improve habitat and maintain the rattlesnake population in Popson Park was amended in favour of relocating rattlesnakes to a more secure location at a newly constructed artificial hibernaculum in Cottonwood Park. During the 2001 and 2002 seasons, numerous problem and vulnerable rattlesnakes were captured, marked, relocated, and maintained at the Cottonwood Park site. In the spring of 2002, several adult captive rattlesnakes were fitted with external transmitters, released from the enclosure, and their movements and activities were tracked.

This project tested two experimental assumptions: 1. After successfully hibernating at the artificial facilities for one winter, rattlesnakes will adopt it as their home den and return in subsequent years to hibernate, and 2. Attaching transmitters (externally) to the rattles is an effective method of radio tracking prairie rattlesnakes.

This report provides a summary of progress and results based on recommendations from 2001 (Appendix 1), and outlines current and future management and recovery strategies aimed at maintaining the Lethbridge prairie rattlesnake population. The ultimate success of this project will be measured on whether or not the Lethbridge population of prairie rattlesnakes can be sustained, however, some biological success and success in the form of public education and cooperation between affected groups and jurisdictions has already been achieved.

2.0 CONSERVATION PROJECT GOAL AND OBJECTIVES

2.1 Goal

To sustain a viable population of prairie rattlesnakes in Lethbridge.

2.2 Objectives

- Educate the public about rattlesnakes.
- Reduce human/snake conflicts in Lethbridge.
- Provide secure long-term habitat for rattlesnakes in Cottonwood Park.
- Maintain captured rattlesnakes at the Cottonwood Park facilities.
- Monitor dispersal of rattlesnakes from the artificial hibernaculum in Cottonwood Park.
- Monitor habitat use by rattlesnakes released from the Cottonwood Park hibernaculum.
- Stimulate research to monitor the Lethbridge rattlesnake population.

3.0 DISTRIBUTION AND STATUS OF THE PRAIRIE RATTLESNAKE IN ALBERTA

In Alberta, the prairie rattlesnake is restricted to the southeastern portion of the province in the Mixed Grass Natural Region which includes mid and short grass prairie. The Alberta government's recent status report (Watson and Russell 1997) states that there is considerable cause for concern as populations of rattlesnakes may be declining across most of their Alberta range. Little is known about the ecology and behaviour of the local populations of rattlesnakes. For more detailed information regarding the distribution and status of the prairie rattlesnake, refer to the Management and Recovery Strategies for the Lethbridge Population of the Prairie Rattlesnake (Ernst 2002).

4.0 STATUS OF THE PRAIRIE RATTLESNAKE IN LETHBRIDGE

The river valley parks within the city contain a small population of rattlesnakes. Although rattlesnakes have been reported at various locations in Lethbridge, the main population exists in the Popson Park area, with a lesser population in the area around Highway 3, west of the Oldman River. Exact numbers are not known, but observations at known hibernacula over the past five years suggest the Lethbridge population of prairie rattlesnakes is approximately 50 adults.

4.1 Threats to the Lethbridge Prairie Rattlesnake Population

The primary threat facing rattlesnakes in Lethbridge continues to be loss of habitat through subdivision and recreational development. Prior to subdivision and recreational development in southwest Lethbridge, the rattlesnake population was relatively isolated from human contact and likely accounts for it remaining in existence. Additional threats include road mortality from increased vehicular traffic on roads intersecting rattlesnake migration routes, deliberate killings by humans, relocating problem snakes to unsuitable areas where their survival is unlikely, and increased potential for human/snake conflicts

in recreational areas as our parks are further developed and park use increases. For more detailed information on threats to the local population, refer to Ernst 2002.

5.0 SUMMARY OF PREVIOUS WORK

In 1997 and 1998, surveys were conducted by the City of Lethbridge in an effort to locate hibernacula, to determine habitat use, and to investigate problems associated with an urban rattlesnake population (Ernst 1998). Specific dates for spring emergence and fall submergence were recorded, and behaviour and movement patterns were observed. Three hibernacula were discovered with a total population estimated at 30 adults; birthing areas were found in conjunction with two of them. Habitat used by rattlesnakes included the coulees associated with the Oldman River drainage and nearby recently developed subdivisions and recreation areas. Conflicts with humans and the killing of rattlesnakes on busy roadways were becoming increasingly common.

Observations in 1998 indicated that the size (and apparent age) of the Lethbridge population of snakes was highly variable. Approximately 30% were large adults, about 50% were intermediate in size (perhaps mature females), and the balance was small (thought to be adolescent or young adults).

In 2000, concern for public safety and concern for unsustainable losses of rattlesnakes attributed to road kills resulted in a rattlesnake management plan being developed (Ernst 2000). The plan emphasized the need for public education, for reducing the conflict between rattlesnakes and people, and for providing long-term and secure habitat for the Lethbridge population of rattlesnakes.

In 2001, the Alberta Conservation Association (ACA) and the Alberta Fish and Wildlife Division provided funding to initiate a project that would educate the public about rattlesnakes and would remove problem and vulnerable rattlesnakes from conflict points and relocate them to more secure habitat. Cottonwood Park was chosen as a potential site for a new hibernaculum because it was a designated nature reserve, removed from urban development, and offered suitable habitat features.

During May of 2001 an artificial hibernaculum was constructed in Cottonwood Park, complete with two winter chambers and an enclosure to contain captured rattlesnakes (Ernst 2002). Eighteen rattlesnakes were captured, relocated, and maintained during the summer of 2001. A clutch of about 12 neonates was born at the Cottonwood Park facilities during the late summer of 2001.

6.0 METHODS

Public education was promoted through the use of interpretive signs, educational brochures, hibernaculum tours, media interviews, and information from the summer Park Ranger. Drift fences and traps were strategically placed to discourage rattlesnakes from entering areas where they would create problems. Calls for snake removals and investigations were responded to promptly. Problem and vulnerable rattlesnakes were

captured and relocated to the Cottonwood Park hibernaculum during 2001 and forced to overwinter there by confining them to an enclosure surrounding the den entrance. A chain link fence with a locked gate was installed around the newly constructed Cottonwood Park hibernaculum to discourage vandalism. Captive rattlesnakes were fed ground squirrel and mouse carcasses throughout the spring and summer, usually at weekly intervals. In 2002 the City of Lethbridge purchased land adjoining Cottonwood Park, providing additional secure rattlesnake habitat.

Snakes were implanted with PIT (passive integrated transponder) tags for long-term identification, and some were also equipped with external radio transmitters used to monitor their movements and habitat use upon being released. PIT tags were implanted subcutaneously about 6 cm anterior to the cloaca using a 12-gauge syringe. Radio transmitters were attached to the rattles using 5-minute epoxy and tape. All work was done at the Cottonwood Park hibernaculum; snakes were captured using snake tongs and traps, and restrained using a portable restraining noose.

All snakes were sexed, weighed, and measured for approximate length; a body condition score was assigned to those processed in September. Body condition scores were ranked from 1 to 5, with 5 being the highest, and were based on the amount of fat bodies the snake had, determined by palpating. Females were palpated to determine reproductive status; a veterinarian supervised all work. Following the release of transmitter-fitted rattlesnakes, radio telemetry was used to track dispersal from the Cottonwood Park hibernaculum (release site) and subsequent habitat use.

During construction of the Cottonwood Park facilities, temperature probes were installed in both winter chambers and temperatures were monitored and recorded throughout the winter and spring of 2002. This data was then used to determine whether the winter chambers provided temperatures within the range tolerated by hibernating rattlesnakes, as well as evaluating the relationship between warming spring temperatures, den temperatures, and spring emergence.

7.0 RESULTS

7.1 Public Education

Education results are difficult to quantify, but because of fewer reports of negative human/snake interactions and because no negative comments about the project have been received, efforts to educate the public are considered successful. Many people have expressed a new attitude towards rattlesnakes and demonstrated their support for our conservation efforts. Two separate reports of motorists stopping to allow rattlesnakes to cross the Paradise Canyon road offer further encouragement. In the past, these rattlesnakes likely would have been road killed.

Additional interpretive signs were constructed and installed in Popson and Cottonwood Parks. Rattlesnake brochures were distributed throughout the Paradise Canyon area, including the Riverstone and Mountain View subdivisions, and were available year-round through various outlets in Lethbridge including the public library and the Fish and

Wildlife office. Nine tours to the Cottonwood Park hibernaculum facilities were conducted through the Helen Schuler Coulee Center (HSCC). Additional tours were offered to interested groups and individuals on an ad hoc basis. Hibernaculum tours were given to Environmental Science students from the Lethbridge Community College and to students enrolled in a field course from the University of Lethbridge. All requests for information were responded to, and media interviews were granted upon request.

7.2 Reduce Human/Snake Conflicts

In May of 2002, a drift fence and traps were positioned between the main Popson Park hibernaculum and the Paradise Canyon area in order to capture rattlesnakes before they became problem or vulnerable. As a result of trapping efforts north of the Popson Park hibernaculum, 5 adult rattlesnakes and 1 neonate were captured and relocated to Cottonwood Park.

Requests from citizens resulted in a total of 10 snake removals. 15 reports of rattlesnake activity were investigated, and 4 reports of rattlesnake mortality were received (see Appendix 5). Compared to 2001, there were only 6 removals versus 10 from the Paradise Canyon area. Within Lethbridge, there were 5 snakes reported killed in 2002 versus 9 in 2001, and only 1 deliberate killing in 2002 versus 3 in 2001; not all reports were confirmed, however.

7.3 Maintaining Rattlesnakes at the Cottonwood Park (CP) Hibernaculum

Both adult and neonate rattlesnakes fed regularly. Pinky (baby mouse) carcasses were fed to 5 neonates born in 2001. One mouse carcass was provided for each rattlesnake, and if all carcasses were consumed promptly, a fresh supply of carcasses was provided. Water was available as required. Some ground squirrel carcasses remained uneaten, perhaps because they were too large to be ingested. Occasionally, a few mouse carcasses were left uneaten, likely because of over feeding. Some adult rattlesnakes were observed to eat two or three mouse carcasses in one feeding session. Competition for food was not evident and food remained uneaten after September 15. Because digestion of food in ectotherms is temperature dependent (Charland and Gregory 1989), rattlesnakes probably quit feeding in mid-autumn to avoid going into hibernation with undigested food.

All rattlesnakes maintained at the Cottonwood Park facilities appeared to be in good condition throughout the summer. Evidence of that may be in the daily observations of mating activity that took place from mid-July to the end of August. As well, a veterinarian examined eight rattlesnakes in September and concluded that body condition was good to excellent on all the snakes examined. Growth of the neonates was not measured, but they grew considerably over the summer. By mid-summer it was obvious that the neonates had shed at least once because they had at least one rattle segment in addition to the button.

A gravid female kept in a separate pen readily fed until mid-July after which she refused to eat. The refusal to feed is not unexpected because gravid females are not obliged to feed during the season they give birth (Graves and Duvall 1993).

7.3.1 Mating and Courtship Activities

Starting in mid-July until early September, intense mating and courtship activities were observed on a regular basis. Most of the activity took place within the enclosure at the Cottonwood Park hibernaculum, but on 2 separate occasions (and locations) courtship and mating activities were observed on a moderate east-facing slope approximately 100 m north of the hibernaculum. One of the previously transmitter-equipped females was involved in mating with an unmarked male, and in the other pair, 1 of the previously transmitter-equipped males was involved in courtship with an unmarked female. Radio contact had been lost with them for about 3 weeks, but reading their PIT tags identified them.

The largest male, after spending a month away from the hibernaculum, slipped his transmitter, made his way back to the hibernaculum, and returned to the enclosure where he was observed to mate with several different females. One evening he was engaged in a vigorous battle with what was assumed to be another male. There was no striking/biting involved, but there was a lot of upper body interaction. Both males would elevate their upper bodies and try to force the other one down. If successful, they would thrash around on the ground before elevating their upper bodies and repeating the process. Promiscuity was evident as various females were observed mating with different males.

7.3.2 Reproduction

Based on the previous 3 years observations, parturition of rattlesnakes in Lethbridge occurred during late August, but in 2002 no neonates were observed until around mid-October. A gravid female at the Cottonwood Park hibernaculum passed 6 unfertilized eggs prior to giving birth to 9 neonates.

7.4 Provide Secure Habitat in Cottonwood Park

In 2002, the City of Lethbridge purchased the property adjoining Cottonwood Park. This acquisition effectively doubled the size of the nature reserve, and therefore, doubled the amount of secure rattlesnake habitat in Cottonwood Park.

There was some minor vandalism at the Cottonwood Park facilities. The chain link fence stops people from entering the enclosure, and along with some overhead netting, helps to keep predators out.

7.5 Marking and Radio Telemetry

Nine adults that had overwintered at the CP hibernaculum were recaptured during the spring of 2002 and implanted with PIT (passive integrated transponder) tags; eight of them were also fitted with external radio transmitters. The eight transmitter-equipped snakes were subsequently released from the enclosure (6 in late May, 2 in mid-June), and their movements were tracked, using radio telemetry, and recorded through mid-summer 2002 (Appendix 4). Six snakes captured during the spring of 2002 were implanted with PIT tags in May, and an additional 9 rattlesnakes captured over the summer were implanted with PIT tags in September. All 15 snakes were released in the CP enclosure for overwintering.

7.6 Transmitter Effectiveness

Although some data was collected using radio telemetry, several snakes had their transmitters detach along with a portion of their rattle before the end of the battery life. This occurred due to rubbing against dense vegetation or during the shedding of skin. As well, due to a technical flaw in the transmitters, very poor range (generally < 50 m) was experienced. Poor range made tracking difficult, requiring more frequent field trips and much extra time to locate transmitter-equipped snakes.

Due to design and technical problems, the effectiveness of externally attached transmitters for radio tracking rattlesnakes was unable to be proven. Telemetry work will be continued in 2003, however, with redesigned transmitters. Subsequently, the success of redesigned transmitters will be evaluated

7.7 Body Condition

Based upon the sample size of 9 snakes, females scored higher on body condition than males (4.25 versus 3.2). These results were not unexpected because males were observed to be more active during the mating season and probably fed less. Data on rattlesnakes equipped with transmitters and PIT tags are summarized in Table 1.

7.8 Dispersal and Habitat Use

All but one of the rattlesnakes dispersed from the Cottonwood Park facilities in easterly and westerly directions. One male moved north. Of the 9 snakes released, 8 were radio-tracked (one snake had insufficient rattle for transmitter attachment). One male travelled 600 m to the eastern portion of the park where he stayed until contact was lost after about 5 weeks. During that time, he was observed to move about 50 m up and down slope on 3 different occasions. All observations were on east-facing slopes and near security and thermal cover (i.e. under shrubs and near ground squirrel burrows). On 1 occasion, a freshly killed ground squirrel carcass was observed near the snake.

The male which travelled north from the hibernaculum was observed in 3 different locations, then contact was lost when his transmitter became detached in dense non-native vegetation on an east-facing slope approximately 200 m north of the hibernaculum. A portion of his rattle detached with the transmitter.

A third male remained for several days in a shrubby thicket 30 m downslope from the hibernaculum. He then travelled east along a steep east-facing slope where contact was lost when his transmitter became detached in dense vegetation.

The other 5 transmitter-equipped snakes (2 males, 3 females) all travelled to the adjoining property west of Cottonwood Park where their movements were confined to east-facing slopes, mainly in dense non-native vegetation. There was considerable movement up, down, and across slope by 4 of the 5 rattlesnakes. Contact was eventually lost with 2 of the females; the third lost her transmitter in dense non-native vegetation along with a portion of her rattle. 1 female was later captured on adjoining private property and returned to the CP hibernaculum, while another was observed in courtship about 200 m north of the CP hibernaculum with an unmarked male.

Of the 2 males, one shed his skin, rattle, and transmitter and contact was lost until he was observed mating with an unmarked female about 150 m north of the hibernaculum. Just prior to shedding he stayed in 1 location for several days, and just prior to that, he made several short movements of 30 m or less along the steep east-facing slope. The other male (the largest) made several movements until he was about 150 m southwest of the hibernaculum. He remained there for several days and then travelled about 200 m north, eventually losing his transmitter in a ground squirrel burrow located about 40 m upslope from the hibernaculum. He was subsequently discovered back at the hibernaculum where he was observed to mate with several different females. He was also observed in combat with an unmarked snake.

The rattlesnakes released in May and June 2002 adapted well to the habitat resources in Cottonwood Park. Observations (bulging of mid-section) of transmitter-equipped snakes indicated foraging success, likely on juvenile ground squirrels.

Table 1: Basic data on captive rattlesnakes.

Date	PIT #	Sex	Weight (gm)	Length (cm)	Body Condition	Action
27/05/02	123955194A	F	600	95	N/a	Fitted with transmitter & released
27/05/02	123976601A	M	700	110	N/a	Fitted with transmitter & released
27/05/02	123965195A	F	700	105	N/a	Gravid, returned to enclosure
27/05/02	124435683A	F	500	98	N/a	Fitted with transmitter & released
27/05/02	123954520A 124435252A	F	400	98	N/a	Released in enclosure (2 PIT tags inserted-1 not reading)
27/05/02	124812174A	M	350	88	N/a	Released in enclosure
27/05/02	124822673A	M	500	100	N/a	Fitted with transmitter & released
27/05/02	123962477A	F	300	88	N/a	Fitted with transmitter & released
27/05/02	124658691A	F	400	97	N/a	Released (insufficient rattle to attach transmitter)
27/05/02	124579394A	M	500	102	N/a	Fitted with transmitter & released
18/06/02	124575213A	M	400	85	N/a	Released in enclosure
18/06/02	124616735A	M	900	110	N/a	Fitted with transmitter & released
18/06/02	123975537A	M	700	110	N/a	Released in enclosure
18/06/02	123952772A	F	300	85	N/a	Released in enclosure
18/06/02	123962727A	M	300	87	N/a	Fitted with transmitter & released
12/09/02	124768356A	M	550	95	3	Released in enclosure
12/09/02	123968185A	F	600	95	4	Released in enclosure
12/09/02	123956445A	M	550	100	3	Released in enclosure
12/09/02	124821446A	F	550	85	4	Released in enclosure
12/09/02	124751572A	F	850	110	4	Released in enclosure
12/09/02	124809625A	M	500	85	4	Released in enclosure
12/09/02	124614792A	M	550	95	3	Released in enclosure
12/09/02	124847286A	M	600	90	3	Released in enclosure
12/09/02	124435795A	F	800	100	5	Released in enclosure

7.8.1 Cottonwood Park Den Fidelity

Of the 9 rattlesnakes released in the spring of 2002, 3 are known to be back at the Cottonwood Park hibernaculum. One male returned in mid-summer after a month of freedom, one female was captured on adjoining private property and returned to the hibernaculum, and a third female was observed back at the den in October of 2002. Because of transmitter problems, the activities of the remaining 6 rattlesnakes after mid-summer were undetermined, although 2 of them were observed (separately) engaged in courtship and mating activities north of the hibernaculum as late as August 21. Their PIT tags were used to identify them.

7.8.2 Den Temperatures, Overwintering Success, and Spring Emergence

Some studies suggest that spring emergence is based on rising temperatures within the den interior (MaCartney et al. 1989), but at the Cottonwood Park hibernaculum that correlation was very weak or non-existent. Temperature probes within the two winter chambers (C1 & C2) at the hibernaculum allowed for monitoring of interior temperatures. Interior den temperatures lagged well behind falling and rising outside air temperatures (Table 2).

In 2002, the first rattlesnake emerged on April 11 when the interior temperature was 5.6^0 C, which was only ½ a degree above the lowest temperature of 5.1^0 C recorded for that chamber during the 2001/2002 winter. Outside air temperature at the time was 17^0 C. Several more rattlesnakes emerged the next day (April 12). In general, the spring of 2002 was particularly cold; during the latter part of March, several overnight lows dropped below -30^0 C.

Studies at naturally occurring hibernacula indicate that overwintering mortality of rattlesnakes can be high, especially for neonates (Gannon and Secoy 1984, Charland 1989). At the Cottonwood Park hibernaculum, neonates were counted in the fall of 2001 just prior to hibernation and again in the spring of 2002. It was concluded that most, if not all of them survived the winter, indicating that the winter den at Cottonwood Park offers suitable refuge from freezing temperatures.

Table 2: Interior and exterior temperatures at the Cottonwood Park hibernaculum (winter 2001/2002).

Date	C1 Interior	C2 Interior	Exterior Temp.
24/11/01	11.9	9.1	1.3
24/12/01	8.3	7.3	7.1
29/01/02	5.1	4.7	-5.6
15/02/02	6.2	5.7	7.4
10/03/02	5.4	3.6	-2.5
06/04/02	5.4	4.3	0.8
11/04/02*	5.6	4.5	17
11/05/02	7.4	6.9	17
11/06/02	10.2	10.7	14
10/07/02	13.8	16.2	28
31/08/02	16.2	17	20

* First snake emerged.

Note: All temperatures in degrees Celsius. C1=winter chamber 1 and C2=winter chamber 2.

8.0 DISCUSSION

8.1 PIT Tags and Radio Transmitters

Being able to positively identify individual rattlesnakes without having to physically handle them is a very valuable tool for long-term studies. PIT tags are an effective and long-term method of marking individual rattlesnakes and do not have any demonstrable impact on movement or growth (Jemison et al. 1995). For this study they proved effective in identifying rattlesnakes found mating, as well as determining which rattlesnakes returned to the Cottonwood Park den to hibernate. Additionally, a PIT tag facilitated monitoring the behaviour of the gravid female.

Studying small populations of rattlesnakes without physically handling them is difficult, and some studies indicate high mortality rates among rattlesnakes implanted with electronic transmitters. Duvall et al. (1985) stated that "of 30 tags, 26 failed and most of the snakes died". As well, many of the pregnant females they implanted failed to give birth. Other studies are less explicit but do hint at problems associated with surgically implanting prairie rattlesnakes with electronic tracking devices. To avoid this problem, in this project we assessed the use of externally attached transmitters. Results from 2002 have led to further modifications of transmitters for the 2003 season.

8.2 Habitat Selection

It was somewhat surprising that all of the transmitter-equipped rattlesnakes selected east-facing slopes in dense non-native vegetation; however, the slopes they did select contained abundant security and thermal cover, as well as substantial ground squirrel activity. It was expected they would select south-facing slopes in native vegetation because those slopes also offered cover and abundant ground squirrel activity, although vegetation was far less dense than on the east-facing slopes. Perhaps the cooler, moister, and more secure features of the east-facing slopes attracted them.

8.3 Feeding

Mid-section bulging of transmitter-equipped snakes indicated successful feeding on prey in Cottonwood Park. Most observations took place near ground squirrel burrows with shading and security cover juxtaposed. On 3 occasions, fresh ground squirrel carcasses were observed in the vicinity of a rattlesnake. Whether the ground squirrel carcass was too big to ingest or whether it remained uneaten for some other reason is not known. Assuming the ground squirrels were envenomated, perhaps when rattlesnakes ambush their prey they cannot always tell whether the prey is an appropriate size for ingesting. It seems unlikely they would waste venom on prey other than to feed.

8.4 Reproduction

Abnormally high precipitation and cool temperatures during the spring and summer of 2002 resulted in reduced sun basking opportunities for gravid females, which may have accounted for the late births. Graves and Duvall (1993) found that gravid female prairie rattlesnakes maintained higher body temperatures than other prairie rattlesnakes and concluded that even small differences in body temperature could have significant effects

on offspring viability. Neonates were first observed at both of the natural hibernacula in Popson Park in October.

8.5 Den Fidelity

The reasons why more of the rattlesnakes released during the spring of 2002 were not observed back at the Cottonwood Park hibernaculum in the fall are not known, but potential reasons include the following:

1. ***Failure to bond to the Cottonwood Park hibernaculum:*** It was reasoned that if the captive rattlesnakes successfully hibernated at the Cottonwood Park artificial den, they would return to hibernate there during the autumn following their spring release. Data collected on the movements of the 8 released rattlesnakes using radio telemetry, and a later discovery in mid-August of 2 of the released rattlesnakes near the den revealed no signs of the snakes migrating outside of the Cottonwood Park area. Their behaviour seemed quite typical of rattlesnakes exploiting their summer habitat (i.e. home range). They hunted prey, and later some of them were observed in courtship and mating activities. It is puzzling why more of the snakes failed to return to hibernate in 2002; however, not knowing the whereabouts or the fate of the other 6 that were released, it is uncertain if it was a failure to bond to the Cottonwood Park den or if they failed to return for some other reason.

Equally puzzling is why none of the approximately 10 rattlesnakes which were born in 2001, and who successfully hibernated at the artificial den, failed to return following their first summer in Cottonwood Park. Since they were born at the Cottonwood Park hibernaculum, it was expected they would return there. The survival rate of young rattlesnakes is very low and it is possible that none survived. Perhaps young rattlesnakes are obliged to follow scent trails left by adults to find their way back to the hibernacula and none were available to them. Knowledge is lacking on the ecology and behaviour of young rattlesnakes.

If the rattlesnakes elected not to return, what might be their fate? It is known that Cottonwood Park is within the home range of another population of rattlesnakes because unmarked snakes have been observed there on several occasions; however, it is not known where the observed snakes came from. If they came from the Popson Park area, the released rattlesnakes may have made their way back to the Popson Park hibernacula, but the known hibernacula in Popson Park were visited several times during the fall of 2002 and no marked rattlesnakes were observed there. Perhaps they are attempting hibernation in mammal burrows (of which there are many) because there are no known natural rattlesnake hibernacula in Cottonwood Park. This seems unlikely however, because many kilometres of foot travel through Cottonwood Park during late summer and autumn of 2002 failed to locate any rattlesnakes. Further telemetry monitoring in 2003 may help to answer some of these questions.

2. ***Predation:*** Numerous raptors were observed in Cottonwood Park, including hawks, and on 1 occasion an eagle. No predation on released rattlesnakes was observed, but raptors are known to prey on rattlesnakes (Klauber 1972). Neonates and yearling

rattlesnakes would likely be prey for other bird species such as magpies and crows. Coyotes (*Canis latrans*) were observed on several occasions, but there was no evidence of predation. Extensive badger (*Taxidea taxus)* activity was evident during the summer and fall of 2002, but no badgers were seen. Badgers are recognized predators, and some reports indicate that the prospect of being envenomated does not deter them from attacking rattlesnakes (Duvall et al. 1985). Mule deer (*Odocoileus hemionus)* were observed on numerous occasions and are also considered potential predators (Klauber 1972). Intentional killing by humans could also be a factor. One unconfirmed report of a rattlesnake being killed in a yard near Cottonwood Park was received.

3. *Undetected returns:* The enclosure at Cottonwood Park is set up in such a way that rattlesnakes can enter but have a very difficult time escaping. It is possible that some snakes returned and remained undetected in one of the tunnels or chambers. PIT tags were checked on a regular basis, however, only the snakes moving around within the enclosure were accessible. If any did return undetected, they should be discovered during the spring release in 2003.

8.6 Other Species Observed

During one visit to the Cottonwood Park hibernaculum, spadefoot toads (*Scaphiopus bombifrons*) were observed in one of the tunnels occupied by rattlesnakes; there was light drizzle occurring at the time. Ground squirrels (*Spermophilus richardsonii)* were observed throughout the park occupying what might be considered atypical habitat (i.e. in dense non-native vegetation). Mice (*Peromyscus sp.*) were also observed. Garter snakes (*Thamnophis sp.*) were observed in Cottonwood Park on several separate occasions well into October. Efforts to locate their hibernaculum (if one exists) were not successful. It was possible that if there was an active garter snake hibernaculum in Cottonwood Park, some of the rattlesnakes may have been found there. Grasshoppers, crickets, and beetles were very plentiful in Cottonwood Park in 2002. They were observed within the enclosure and near the neonates, but no predation by the neonates was observed.

8.7 Popson Park Hibernacula

In 1998 there were 2 known hibernacula in Popson Park. Monitoring in 2000 indicated that only one was still active, but in 2002, a new hibernaculum was discovered about 200 m from the inactive one. It seems likely that for some reason the old hibernaculum became unusable and was abandoned in favour of the new site. As at the old hibernaculum, the new site contained both rattlesnakes and garter snakes.

The 2 active hibernacula at Popson Park were monitored to gather information on spring and fall migration times and directions, to determine population demographics, and to determine if any neonates were born. Spring migration was initiated around May 20 and snakes started to arrive back at the hibernacula around September 15. Juveniles and sub-adults were observed at both hibernacula indicating that recruitment is taking place in the Popson Park population. Neonates were observed at both hibernacula in mid-October, which is about 6 weeks later than observations from other years.

8.8 Research Opportunities

Lethbridge rattlesnakes are urban and face social and ecological problems different from populations in remote areas. Other than the Lethbridge project, there is no known research aimed at establishing a population of prairie rattlesnakes at an artificial hibernaculum, nor has any work been done (to our knowledge) using externally attached transmitters on rattlesnakes for radio telemetry tracking purposes.

Research opportunities exist for long-term graduate projects in a number of areas, including the following: 1. Determine the carrying capacity of Cottonwood Park and study ways to maintain it. For example, maintaining a suitable population of ground squirrels may be critical to conservation efforts. 2. How does the carrying capacity relate to a minimum viable population (MVP) for rattlesnakes? No studies of this nature have been revealed through a literature search. 3. How does the Lethbridge population interact with other populations in the Lethbridge area? Known sites exist across the river from Cottonwood Park to the south along the St Mary's river, and to the north along the west side of the river north of Lethbridge.

8.9 Future Conservation Strategies

Further research is required to determine how many rattlesnakes are necessary to maintain a population in Lethbridge over the long term (i.e. > 100 years), and strategies may need to be developed to contain rattlesnakes within Cottonwood Park to minimize conflicts with adjacent landowners.

In the future, problem rattlesnakes will be released at the Cottonwood Park hibernaculum with the hope they will recognize it as a suitable winter den and return to hibernate. To evaluate whether this will actually happen, a number of rattlesnakes should be fitted with transmitters (in 2003) and monitored to determine how they react to being relocated.

9.0 RECOMMENDATIONS FOR 2003

- Continue with the education and coordination activities initiated in 2001.
- Continue to capture, mark, relocate, and maintain problem and vulnerable rattlesnakes.
- Capture and mark all rattlesnakes at the Cottonwood Park hibernaculum prior to release during the spring of 2003.
- Attach redesigned transmitters to adult rattlesnakes at the Cottonwood Park hibernaculum prior to release in the spring of 2003.
- Using radio telemetry and other methods, monitor rattlesnake movements and activities during the summer of 2003. Evaluate effectiveness of the redesigned transmitters.
- If necessary, install fencing and traps at the east end of Cottonwood Park to intercept migrating rattlesnakes. Release (do not contain) any captured rattlesnakes near the Cottonwood Park hibernaculum.
- Install fencing and traps near the Popson Park hibernaculum to intercept rattlesnakes migrating north towards developed areas of Paradise Canyon. These

rattlesnakes would be considered problem or vulnerable and should be maintained at the Cottonwood Park hibernaculum during 2003, to be released in spring 2004.

- Install traps around the outside perimeter of the Cottonwood Park hibernaculum fence to capture returning rattlesnakes in the fall of 2003.
- Allow the existing population of rattlesnakes to remain in Popson Park unless development or other factors make it no longer practical to do so.
- During the fall of 2003, do a sweep of Cottonwood Park and the surrounding area to search for and capture marked rattlesnakes for release back at the Cottonwood Park hibernaculum.
- In 2003, contain and feed the neonates born at the Cottonwood Park facilities. Their chances of survival, and therefore becoming part of the Cottonwood Park population, are considered much greater if released as juveniles rather than neonates.
- Monitor rattlesnake activities on the private lands adjoining Cottonwood Park. If landowners do experience problems associated with current conservation efforts, mitigation measures must be implemented. These may take the form of fencing and traps (and monitoring) along conflict points.
- Attach transmitters to a few rattlesnakes captured in 2003 and release at the Cottonwood Park hibernaculum. Monitor their movements to determine if they try to return to their point of capture, or if they recognize the Cottonwood Park hibernaculum as a suitable place to hibernate (i.e. will they use the Cottonwood Park habitat and return to the Cottonwood Park den to winter?).
- Establish a rattlesnake sanctuary in Cottonwood Park that would also provide an area to relocate problem snakes from other parts of the city.
- Construct and install signage on formal trails in Cottonwood Park advising users to stay on developed trails during the spring, summer, and fall to help prevent surprise encounters between humans and rattlesnakes.
- Maintain ground squirrel colonies on sites away from trails to reduce human/snake conflicts associated with rattlesnakes travelling in search of prey.

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11.0 APPENDICES

Appendix 1 - Recommendations for 2002 (excerpted from Ernst 2002)

Continue with the education and coordination activities initiated in 2001.

- Continue to capture, mark, relocate, and maintain problem and vulnerable rattlesnakes.
- Capture and mark all rattlesnakes at the Cottonwood Park hibernaculum prior to release during the spring of 2002.
- Install external transmitters to adult rattlesnakes at the Cottonwood Park hibernaculum prior to release in the spring of 2002.
- Using radio telemetry and other methods, monitor rattlesnake movements and activities during the summer of 2002.
- Contain and feed neonate rattlesnakes at the Cottonwood Park hibernaculum prior to release in the spring of 2002.
- Provide fencing and traps at the east end of Cottonwood Park to intercept migrating rattlesnakes. Release (do not contain) any captured rattlesnakes back at the Cottonwood park hibernaculum.
- Provide fencing and traps near the Popson Park hibernaculum to intercept rattlesnakes migrating north towards Paradise Canyon. These rattlesnakes would be considered problem or "at risk" and would be maintained at the Cottonwood Park hibernaculum during 2002.
- Install interpretive signs in Popson and Cottonwood Parks.
- Install traps around the outside perimeter of the Cottonwood Park hibernaculum fence to capture returning rattlesnakes in the fall of 2002.
- During the fall of 2002, do a sweep of Cottonwood Park and surrounding area to search for and capture marked rattlesnakes for release back at the Cottonwood Park hibernaculum. For adult recapture, this should be facilitated by radio telemetry; however, the function and efficacy of attached transmitters is still unknown.
- If hibernacula population density estimates outside of Lethbridge are desirable, during the spring of 2002, provide fencing and traps at possible sites located during 2001.

Appendix 2 - Rationale for the Cottonwood Park Conservation Strategy

Relocate problem rattlesnakes from other areas of Lethbridge to Cottonwood Park

Advantages:

- May increase genetic diversity of the Lethbridge population.
- A larger population may have a better chance of surviving than a few small isolated ones (more breeding opportunities, etc.).
- Decrease the number of human/snake conflict points within Lethbridge.
- Cottonwood Park seems to offer excellent habitat for rattlesnakes (a large ground squirrel population and favourable topographical features).
- May be easier to gain public support to maintain a population in one area away from urban areas compared to scattered groups of rattlesnakes.
- Cottonwood Park offers more security than most other areas in Lethbridge.
- Some reassurance to the public knowing that the likelihood of chance encounters with a rattlesnake in other parts of the city is reduced.

Disadvantages:

- Relocated snakes may not show fidelity towards their new hibernaculum.
- May be objections from nearby residents and property owners.

Appendix 3 - Overview of Management Actions and Progress for 2002 (excerpted and revised from Ernst 2002)

Management Objective 1. Provide public education regarding rattlesnakes. Focus on their importance, conservation, and safety precautions.		**Responsibility**	**Progress**
Action 1.1	Distribute the "Rattlers, People and Parks" Brochure widely, but focus on residents in the vicinity of the snake populations.	Consultant	Widely distributed, Ongoing
	1.1.1 Make available for pick-up at the Nature Center, Library, Paradise Canyon, City of Lethbridge & University of Lethbridge.	Consultant	Ongoing
	1.1.2 Annual distribution to Paradise Canyon residents in conjunction with their newsletter. Consider wider distribution in other neighbourhoods as required.	Paradise Canyon Community	Done in spring 2002
	1.1.3 Make the brochure available at Popson and Cottonwood Parks.	City of Lethbridge	Ongoing, April-October
Action 1.2	Issue public service announcement regarding rattlesnake safety and conservation.	Consultant and NRS	Done through media during 2002
Action 1.3	Hold at least one interpretive program each year on snakes in the City.	Helen Schuler Coulee Center (HSCC)	Annually
Action 1.4	Have the City Parkland Ranger educate park users about rattlesnakes (discussion and brochure distribution)	City of Lethbridge	Done annually, May-September
Action 1.5	Provide interpretive signs at Popson and Cottonwood Parks to provide information about rattlesnakes.	City of Lethbridge	Ongoing from 2001
Action 1.6	Make rattlesnake information posters available at relevant events (e.g. Cactus Coulee Crawl 2001)	Consultants & NRS	Ongoing
Management Objective 2. Alter risky migration patterns by providing suitable and secure habitat in Cottonwood Park.		**Responsibility**	**Progress**
Action 2.1	Maintain ground squirrel colonies in Cottonwood Park.	Consultant & City of Lethbridge	No action required
Action 2.2	Maintain ground squirrel habitat in Cottonwood Park (annual mowing or burning on selected sites).	City of Lethbridge	Ongoing
Management Objective 3. Reduce human/snake conflicts in the Paradise Canyon, Popson Park, and other areas.		**Responsibility**	**Progress**
Action 3.1	Provide trained people to relocate problem rattlesnakes. This would include proper capture, marking, and release techniques.	Fish and Wildlife (Conservation officers)	Ongoing
Action 3.2	Provide contact names and phone numbers for citizens to report problem snakes.	Fish and Wildlife, Consultant & HSCC	Done in spring 2002
Action 3.3	Provide education (see Management Objective 1).		Ongoing
Action 3.4	Provide fencing to restrict rattlesnakes from entering residential areas.	NRS & Consultants	Done in spring 2002
Management Objective 4. Provide secure hibernacula and foraging areas for rattlesnakes in Lethbridge.		**Responsibility**	**Progress**
Action 4.1	Establish a Wildlife Control Zone around the hibernaculum in Cottonwood Park.	NRS	Not pursued

Action 4.2	Do not reveal location of hibernacula unless there is a definite need to know.	City of Lethbridge	Ongoing
Action 4.3	Establish a hibernaculum in Cottonwood Park.	City of Lethbridge/NRS/ Consultant	Completed May, 2001
	4.3.1 Fence area around hibernaculum to prevent snakes from escaping and to provide some security for resident snakes.	NRS	Completed May, 2001
	4.3.2 Feed resident rattlesnakes	NRS/Consultant	Ongoing
	4.3.3 Install fencing and traps along north end of CP to capture snakes returning to PP and relocate snakes to CP hibernaculum.	NRS/Consultant	Done in spring 2002
	4.3.4 Install additional fencing around CP to prevent snakes from migrating onto road or into adjacent acreage development.	NRS/Consultant	Not required at this time
Action 4.4	Restrict development in Cottonwood Park that would negatively impact rattlesnakes or their habitat.	City of Lethbridge	Ongoing (protected as a nature reserve)
Action 4.5	Investigate the possibility of acquiring adjacent land (Veselenak property) for inclusion in CP.	City of Lethbridge/ Consultant	Purchased by City of Lethbridge in 2002
Management Objective 5. Reduce killing of rattlesnakes by humans.		**Responsibility**	**Progress**
Action 5.1	Provide education (see Management Objective 1)	NRS, Consultants, & City of Lethbridge	Ongoing
Action 5.2	Prosecute the deliberate killing of rattlesnakes.	Fish and Wildlife	Ongoing
Action 5.3	Relocate snakes from other areas of Lethbridge to Cottonwood Park (e.g. Bickman property, Bridgeview RV Park).	NRS	Ongoing
Action 5.4	Provide trained people to relocate problem rattlesnakes from residential areas and off of roads and adjacent areas.	NRS	Ongoing snake handling workshop
Management Objective 6. Through research, improve understanding of rattlesnake movement, numbers, and population dynamics in Lethbridge. Identify and locate suitable habitat features (e.g. potential ground squirrel colony sites).		**Responsibility**	**Progress**
Action 6.1	Continue to collect and record all snake reports from the NRS, the Paradise Canyon Golf and Country Club, and the public.	Fish and Wildlife, Consultants, & HSCC	Done annually April- October
	6.1.1 Maintain snake database initiated by the City of Lethbridge, Natural Resource Manager in 1998.	HSCC	Ongoing
Action 6.2	Search for additional hibernacula.	Consultant	Done in 2001 and 2002
Action 6.3	Install traps around inside perimeter of CP hibernaculum fencing. Capture snakes ready to migrate, spray paint rattle section, and install external transmitter to allow tracking.	NRS/Consultant	Done in April/May, 2002
Action 6.4	Install traps around outside perimeter of CP hibernaculum and capture returning snakes for census information.	NRS/Consultant	Done in August/ September 2002

Action 6.5	Mark captured snakes by spray painting rattle section. Marking to be used to increase knowledge of movement patterns and habitat use.	NRS	Ongoing
Management Objective 7. Continue activities aimed at relocating the PP rattlesnake population to secure habitat in CP.		**Responsibility**	**Progress**
Action 7.1	Continue capturing and removing problem and at risk rattlesnakes to the CP hibernaculum.	Fish and Wildlife/NRS/ Consultant	Ongoing
Action 7.2	Assuming the CP hibernaculum effort is successful: install fencing and traps around PP hibernaculum to capture returning snakes, spray paint rattle section, and relocate to CP hibernaculum.	NRS/Consultant	Not required at this time
Action 7.3	Expand the capacity of the CP hibernaculum to accommodate a population increase.	NRS	2004
Action 7.4	Continue education efforts, habitat maintenance, and working with other groups	NRS/Consultant City of Lethbridge	Ongoing
Action 7.5	Determine when recovery efforts are no longer viable or when the Lethbridge rattlesnake population has recovered to the point where active intervention is no longer desirable.	NRS/Consultant	Evaluate in 2004

* Funding provided by the Alberta Conservation Association

Appendix 4 - 2002 Dispersal Data

Date	Snake	PIT tag #	Sex	Habitat	Location Relative to Hibernaculum	Activity
212 released from CP hibernaculum on 27/05/02, tx freq 150.212 & with PIT tag.						
29/05/02	212	123955194A	F	S facing steep slope in burrow	30 m NW	N/a
31/05/02	212	123955194A	F	E facing steep slope near top	110 m W	Basking
01/06/02	212	123955194A	F	E facing steep slope near top	110 m NW	Basking under shrub
06/06/02	212	123955194A	F	E facing steep slope near top	110 m W	Basking under shrub
13/06/02	212	123955194A	F	E facing terrace, non-native vegetation	130 m NW	Basking
19/06/02	212	123955194A	F	E facing terrace, non-native vegetation	135 m SW	Basking
21/06/02	212	123955194A	F	E facing terrace, non-native vegetation	135 m SW	Basking
28/06/02	212	123955194A	F	Toe of E facing slope, non-native vegetation	175 m SW	Basking
12/07/02	212	123955194A	F	Toe of E facing slope, non-native vegetation	175 m SW	Basking
17/07/02	212	123955194A	F	Steep E facing slope	250 m SW	Found in dense non-native vegetation
18/07/02	212	123955194A	F	Flat upland	325 m W	Found in debris & rocks
18/07/02	**Captured on adjacent private property and returned to CP hibernaculum**					

Date	Snake	PIT tag #	Sex	Habitat	Location Relative to Hibernaculum	Activity
063 released from CP hibernaculum on 27/05/02, tx freq 150.063 & with PIT tag.						
04/06/02	063	123976601A	M	Steep E facing mid-slope	500 m E	Basking in vegetation
07/06/02	063	123976601A	M	SE facing slope near toe 40 m N of previous	500 m E	Basking, dead shrub
15/06/02	063	123976601A	M	E facing slope near toe 50 m E of previous	600 m E	Basking in vegetation
18/06/02	063	123976601A	M	SE facing mid-slope 150 m SE of previous	600 m E	Basking in vegetation
23/06/02	063	123976601A	M	SE facing mid-slope 150 m SE of previous	600 m E	Basking in vegetation
28/06/02	063	123976601A	M	SE facing mid-slope 150 m SE of previous	600 m E	Basking in vegetation
04/07/02	**Lost contact and not regained.**					

Date	Snake	PIT tag #	Sex	Habitat	Location Relative to Hibernaculum	Activity
256 released from CP hibernaculum on 27/05/02, tx freq 150.256 & with PIT tag.						
01/06/02	256	124435683A	F	SE slope near truck trail, mixed vegetation	100 m NW	Basking
03/06/02	256	124435683A	F	Steep E slope above truck trail, non-native vegetation	200 m W	Basking
04/06/02	256	124435683A	F	Steep E slope above truck trail, non-native vegetation	200 m W	Basking
07/06/02	256	124435683A	F	Very steep E slope above truck trail, dense non-native vegetation	300 m W	Basking
13/06/02	256	124435683A	F	Very steep E slope above truck trail, dense non-native vegetation	300 m W	Basking
15/06/02	256	124435683A	F	Very steep E slope above truck trail, dense non-native vegetation	300 m W	Basking
19/06/02	256	124435683A	F	Steep E slope above truck trail, dense non-native vegetation	200 m SW	Basking
21/06/02	256	124435683A	F	Steep E slope above truck trail, dense non-native vegetation	200 m SW	Basking
26/06/02	256	124435683A	F	Steep E slope above truck trail, dense vegetation	SW on Hubbard's property	Not seen
Lost signal on 07/07/02. Believed to be on Hubbard's property. Relocated on 11/08/02 by PIT tag (no tx) 110 m N of hibernaculum. Engaged in mating activity until 21/08/02 @ same location, then lost contact.						

Date	Snake	PIT tag #	Sex	Habitat	Location Relative to Hibernaculum	Activity
137 released from CP hibernaculum on 27/05/02, tx freq 150.256 & with PIT tag.						
29/05/02	137	124822673A	M	Near base of steep SE slope	100 m W	Basking in vegetation
31/05/02	137	124822673A	M	Near top of steep E slope	110 m W	Basking under shrub
01/06/02	137	124822673A	M	Near base of steep E slope in dense non-native vegetation	150 m W	Basking
04/06/02	137	124822673A	M	Near top of steep E slope, non-native vegetation	210 m W	Basking
06/06/02 15/06/02	137	124822673A	M	Near middle of steep E slope, non-native vegetation	250 m W	Basking
19/06/02 24/06/02	137	124822673A	M	Toe of E slope in dense non-native vegetation	200 m SW	Basking
28/06/02 Found shed skin, rattle & tx @ above location. Relocated via PIT tag on 27/07/02 (100 m N of hibernaculum). Engaged in courtship/mating activities, then lost contact.						

Date	Snake	PIT tag #	Sex	Habitat	Location Relative to Hibernaculum	Activity
167 released from CP hibernaculum on 27/05/02, tx freq 150.167 & with PIT tag.						
01/06/02	167	123962477A	F	Steep upper SE slope	100 m NW	Basking
06/06/02	167	123962477A	F	Steep E slope above road, non-native vegetation	200 m W	Basking
13/06/02 28/06/02	167	123962477A	F	Steep E slope above road, non-native vegetation	200 m W	Basking
01/07/02 Found detached rattle & tx near above position. No subsequent contact.						

Date	Snake	PIT tag #	Sex	Habitat	Location Relative to Hibernaculum	Activity
121 released from CP hibernaculum on 27/05/02, tx freq 150.167 & with PIT tag.						
29/05/02 10/06/02	121	124579394A	M	Steep E facing slope in vegetation	30 m S	Basking
15/06/02	121	124579394A	M	Steep E facing slope in vegetation	60 m E	Not seen
16/06/02 Lost tx at above position. No subsequent contact.						

Date	Snake	PIT tag #	Sex	Habitat	Location Relative to Hibernaculum	Activity
092 released from CP hibernaculum on 18/06/02, tx freq 150.092 & with PIT tag.						
20/06/02	092	124616735A	M	Steep E slope in vegetation	25 m N (upslope)	Basking
21/06/02	092	124616735A	M	Near toe of steep E slope in vegetation below truck trail	125 m W	Not seen
23/06/02 28/06/02	092	124616735A	M	On E facing bench just below truck trail in non-native vegetation	250 m S	Basking
12/07/02	092	124616735A	M	E slope between trails, 300 m N of previous	150 m N	Not seen
14/07/02	092	124616735A	M	At top of SE slope	50 m N (upslope)	Not seen (burrow)
Lost tx @ above position in burrow. 092 returned to hibernaculum (identified by PIT tag) and engaged in intense mating and competition until ~ 01/09/02.						

Date	Snake	PIT tag #	Sex	Habitat	Location Relative to Hibernaculum	Activity
078 released from CP hibernaculum on 18/06/02, tx freq 150.078 & with PIT tag.						
19/06/02	078	123962727A	M	Steep E slope	30 m NE (upslope)	Basking in vegetation
23/06/02	078	123962727A	M	Steep E slope in lush non-native vegetation, just above red shale trail	150 m NE	Basking
24/06/02 28/06/02	078	123962727A	M	Steep E slope in lush non-native vegetation, just below red shale trail	200 m NE	Not seen

04/07/02 07/07/02	078	123962727A	M	Steep E slope in lush vegetation, just above red shale trail	250 m NE	Not seen
Lost tx @ above position. No subsequent contact.						

Appendix 5 - 2002 Rattlesnake Captures, Deaths, & Investigations

Date	Location	Action
14/05/02	Bickman Property	Caught 1 gravid female & released in CP enclosure.
19/05/02	Popson Park	Trapped 1 adult snake north of hibernaculum. Removed, marked red and green, and released in CP enclosure
20/05/02	Popson Park	Trapped 1 adult snake north of hibernaculum. Removed, marked red and green, and released in CP enclosure. Also 1 baby caught and released in CP enclosure.
21/05/02	Popson Park	Trapped 3 adults north of hibernaculum. Removed, marked red and green, and released in CP enclosure.
01/06/02	Paradise Canyon	Investigated report of rattlesnake along coulee rim behind Canyon Blvd. Snake not found.
16/06/02	Popson Park	Caught a male with broken rattle ~ 50 m south of Popson Park turnoff in middle of road. Released in CP enclosure.
19/06/02	Paradise Canyon	Baby rattlesnake in garage @ 34 Canyon Blvd. Removed and released in CP enclosure.
22/06/02	Popson Park	Caught a large adult near picnic shelter. Marked red and released in CP enclosure.
06/02	Paradise Canyon	Juvenile removed from 34 Canyon Blvd and released at PP hibernaculum.
28/06/02	Denecky Property	Rattlesnake run over in yard. Removed and died later.
06/02	Paradise Canyon	Dead rattlesnake reported on road.
07/02	AT&T microwave tower	Investigated report of small snake on property. Not found.
18/07/02	Hubbard Property	Located 211 (female) with another snake. Caught both and released in CP enclosure. Likely courting.
21/07/02	Par 3	Removed 1 adult to CP enclosure. Marked red.
28/07/02	Paradise Canyon	Removed 1 adult from #75 Canyon Blvd. Marked red and released in CP enclosure.
29/07/02	Cottonwood Park	Believed to be escapee from enclosure. Mating with 137 ~ 100 m north of enclosure. Caught and released in CP enclosure.
06/08/02	Bridge Drive	Report of dead rattlesnake on road by Par 3.
06/08/02	Bridge Drive	Investigated report of snake on road. Found 1 dead adult.
06/08/02	Hubbard Property	Landowner was given adult snake by oil company employee, caught across river. Released (unmarked) in CP enclosure.
08/02	Paradise Canyon	Report of dead rattlesnake on road but not confirmed.
08/08/02	Paradise Canyon	One adult removed from #45 Canyon Blvd. Marked red and released in CP enclosure.
18/08/02	Fekete Property	Landowner reported he had a captured rattlesnake. Investigated; landowner decided to release the snake on his property.
22/08/02	Paradise Canyon	Removed one adult from golf course, marked red, and released in CP enclosure.
23/08/02	Paradise Canyon	Call re: snake along road. Investigated, but no snake found.
25/08/02	Paradise Canyon	Investigated previous call from #48 Canyon Blvd. No snake found.
27/08/02	Paradise Canyon	Removed one adult from golf course, marked red, and released in CP enclosure.
29/08/02	Paradise Canyon	Investigated 3 separate reports (2 trips) of rattlesnake activity. None found. Set up trap at #28 Canyon Blvd., but no snakes trapped.
07/09/02	453 Leaside Dr.	Removed a juvenile or small adult from a residence, marked red, and released at CP hibernaculum. Since this site is near

		Henderson Lake and the snake was identified as a northern pacific rattlesnake (*Crotalus viridis oreganos),* it may have come in from outside our area (i.e.BC), perhaps on a load of hay to the Exhibition Grounds.
19/09/02	1025 25 St. S	Investigated report of snake in alley. None found.

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